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09/188,190	11/10/1998	KATSUNORI KANEKO	1472-177P	4015

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EXAMINER
NGUYEN, TU MINH

ART UNIT	PAPER NUMBER
3748	35

DATE MAILED: 08/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/188,190	Applicant(s) Kaneko et al.
	Examiner Tu M. Nguyen	Art Unit 3748

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Jul 24, 2003*.

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1 and 3-23* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1 and 3-23* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Oct 2, 2002* is/are a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some* c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. An Applicant's Amendment filed on July 24, 2003 has been entered.

Claim 1 has been amended; and claims 16-23 have been added. Overall, claims 1 and 3-23 are pending in this application.

Drawings

2. The formal drawing of Figure 5 filed on October 2, 2002 has been approved for entry.

Claim Objections

3. Claims 1, 22, and 23 are objected to because

- Claims 1, 22, and 23, line 10 of each claim, "down stream" should read --downstream position--. Line 11 of each claim, "mans" should read --means--.

- Claim 22, line 3 from the bottom of the claim, "an lean" should read --a lean--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claim 21 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification fails to disclose an engine air-fuel ratio required to release the adsorbed NO_x from the NO_x catalyst in the case for a light-off catalyst with reduced O_2 storage capability is set leaner than that in the case for another light-off catalyst in which the O_2 storage capability is not reduced. OK, but claim 21 is still rejected under prior art!

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.
>
> The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

7. Claim 22 is rejected under 35 U.S.C. 102(e) as being anticipated by Hepburn et al. (U.S. Patent 5,974,788) (Hepburn'788).

As shown in Figure 1, Hepburn'788 discloses an exhaust gas purifying apparatus of an internal combustion engine, comprising:

- a light-off catalyst (26) provided in an exhaust passage and having a O_2 storage capability such that the light-off catalyst passes, therethrough, at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced (lines 44-52 of column 4 and line 63 of column 3 to line 10 of column 4);

- exhaust gas purifying means (32) provided in the exhaust passage at a downstream position of and in series with the light-off catalyst, the exhaust gas purifying means having a NO_x catalyst (a NO_x trapping material) for adsorbing NO_x in an exhaust gas when an air-fuel ratio of the exhaust gas is lean and releasing the adsorbed NO_x in an exhaust gas when the oxygen concentration of the exhaust gas is reduced, the exhaust gas purifying means further having a three-way catalyst (a noble metal) that reacts with the released NO_x (purifying means (32) in Hepburn'788 removes HC, CO, and NO_x in the exhaust gas at stoichiometric or slightly rich condition (lines 13-18 and 39-48 of column 1)); and

- control means (20, 16) for switching an air-fuel ratio of the exhaust gas from a lean air-fuel ratio to a stoichiometric air-fuel ratio or a rich air-fuel ratio while maintaining temperature of the NO_x catalyst under a temperature in which SO_x is released (as indicated on line 64 of

column 2 to line 12 of column 3 and lines 27-42 of column 3, the engine air-fuel ratio is modulated with the cylinders operated lean for 10 events and then operated rich for 10 events to raise the NO_x catalyst to as high as 700°C under which trapped SO_x in the catalyst is released).

8. Claims 22 and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by Murachi et al. (U.S. Patent 5,746,989).

Re claim 22, as shown in Figure 1, Murachi et al. disclose an exhaust gas purifying apparatus of an internal combustion engine, comprising:

- a light-off catalyst (5) provided in an exhaust passage and having an O_2 storage capability such that the light-off catalyst passes, there through, at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced (see line 66 of column 3 to line 8 of column 4) (light-off catalyst (5) has limited oxygen storage capability because when the engine air-fuel ratio is switched to fuel rich, much of HC and CO in the exhaust gas pass through the light-off catalyst (5) unoxidized (lines 29-38 of column 6));

- exhaust gas purifying means (9) provided in the exhaust passage at a downstream position of and in series with the light-off catalyst, the exhaust gas purifying means having a NO_x catalyst (alkaline earth metals such as barium) for adsorbing NO_x in the exhaust gas when an air-fuel ratio of the exhaust gas is lean and releasing the adsorbed NO_x when the oxygen concentration of the exhaust gas is reduced, the exhaust gas purifying means further having a three-way catalyst (platinum) that reacts with the released NO_x (line 50 of column 4 to line 36 of column 5); and

- control means (20, 4) for switching an air-fuel ratio of the exhaust gas from an lean air-fuel ratio to a stoichiometric air-fuel ratio or a rich air-fuel ratio while maintaining temperature of the NO_x catalyst under a temperature in which SO_x is released (lines 43-64 of column 8).

Re claim 23, as shown in Figure 1, Murachi et al. disclose an exhaust gas purifying apparatus of an internal combustion engine, comprising:

- a light-off catalyst (5) provided in an exhaust passage and having an O_2 storage capability such that the light-off catalyst passes, there through, at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced (see line 66 of column 3 to line 8 of column 4) (light-off catalyst (5) has limited oxygen storage capability because when the engine air-fuel ratio is switched to fuel rich, much of HC and CO in the exhaust gas pass through the light-off catalyst (5) unoxidized (lines 29-38 of column 6));

- exhaust gas purifying means (9) provided in the exhaust passage at a downstream position of and in series with the light-off catalyst, the exhaust gas purifying means having a NO_x catalyst (alkaline earth metals such as barium) for adsorbing NO_x in the exhaust gas when an air-fuel ratio of the exhaust gas is lean and releasing the adsorbed NO_x when the oxygen concentration of the exhaust gas is reduced, the exhaust gas purifying means further having a three-way catalyst (platinum) that reacts with the released NO_x (line 50 of column 4 to line 36 of column 5); and

- control means (20, 4) for repeatedly releasing NO_x adsorbed by the NO_x catalyst every first interval (2 minutes) and repeatedly releasing SO_x adsorbed by the NO_x catalyst every second interval (60 minutes) longer than the first interval (see Figure 5 and lines 43-64 of column 8, especially lines 57-60 of column 8).

9. Claims 1, 8-15, and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Hepburn (U.S. Patent 5,771,685) (Hepburn'685).

Re claim 1, as shown in Figure 1, Hepburn'685 discloses an exhaust gas purifying apparatus of an internal combustion engine, comprising:

- a light-off catalyst (26) provided in an exhaust passage and having a O_2 storage capability such that the light-off catalyst passes, therethrough, at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced (as indicated on lines 6-9 of column 4, during a NO_x purge, CO from the engine passes through the light-off catalyst (26) and reacts in a reducing reaction with NO_x released from a NO_x catalyst);

- exhaust gas purifying means (32) provided in the exhaust passage at a downstream position of and in series with the light-off catalyst, the exhaust gas purifying means having a NO_x catalyst (an NO_x trapping material) for adsorbing NO_x in an exhaust gas when an air-fuel ratio of the exhaust gas is lean and releasing the adsorbed NO_x in an exhaust gas when the oxygen concentration of the exhaust gas is reduced, the exhaust gas purifying means further having a three-way catalyst (a noble metal) that reacts with the released NO_x (the purifying means (32) of

Hepburn'685 removes HC, CO, and NO_x in the exhaust gas at a rich condition (lines 60-63 of column 4)); and

- control means (20, 16) for reducing the oxygen concentration in the exhaust gas such that the CO that passed through the light-off catalyst is introduced to the NO_x catalyst when a NO_x conversion efficiency of the NO_x catalyst is decreased and maintaining the reduced oxygen concentration until the adsorbed NO_x in the NO_x catalyst is released (as shown in Figure 7, when a NOx conversion or storage efficiency is less than a predetermined value (step 112 with YES answer), a lean time T1 is reduced (step 114), the engine is then run with a lean air-fuel ratio for the reduced lean time T1 during which NO_x in the exhaust gas is trapped and stored in the NO_x catalyst; after the time T1, a regeneration cycle with a rich air-fuel ratio is performed to purge NO_x trapped by the NO_x catalyst (steps 96 with YES answer, 98, 92 with NO answer, and 100)).

Re claim 8, in the apparatus of Hepburn'685, the internal combustion engine is a spark ignition type four-cycle engine that operates on the four-stroke cycle consisting of a suction stroke, compression stroke, combustion/expansion stroke, and exhaust stroke.

Re claim 9, in the apparatus of Hepburn'685, the internal combustion engine is an in-cylinder injection type engine in which fuel is directly injected into a combustion chamber (lines 45-48 of column 2).

Re claims 10 and 11, the single catalyst of the exhaust gas purifying means (32) in the apparatus of Hepburn'685 includes a function of the three-way catalyst.

Re claim 12, the light-off catalyst (26) in the apparatus of Hepburn'685 includes a single catalyst that functions as the three-way catalyst (lines 54-56 of column 2).

Re claim 13, the exhaust gas purifying means (32) in the apparatus of Hepburn'685 further functions also as the NO_x catalyst.

Re claim 14, the light-off catalyst (26) in the apparatus of Hepburn'685 also functions as a SO_x catalyst to oxidize and convert SO_2 in the exhaust gas to a sulfate which can be absorbed by the exhaust gas purifying means.

Re claim 15, in the apparatus of Hepburn'685, the condition where the oxygen concentration of the exhaust gas is reduced includes a fuel rich operating condition (lines 60-63 of column 4).

Re claim 17, in the apparatus of Hepburn'685, the light-off catalyst (26) is provided in the exhaust passage immediately downstream of the internal combustion engine.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hepburn'685 as applied to claim 1 above, in view of design choice.

The apparatus of Hepburn'685 discloses the invention as cited above, however, fails to disclose that an amount of oxygen absorbed on the light-off catalyst is not greater than about 150 cc per one-liter volume of the catalyst when measured by an oxygen pulse method and that an oxygen component stored in the light-off catalyst is not greater than about 25 gr per one-liter volume of the catalyst.

One having ordinary skill in the art of exhaust emission control would have recognized that the specification of the maximum volumetric or weighted amount of oxygen absorbed in a light-off catalyst would be a function of many variables such as the size of the light-off catalyst, engine size, engine operating conditions (load, speed, etc), air and fuel properties, capacity and size of a main catalyst, etc. Moreover, there is nothing in the record which establishes that the claimed maximum volumetric or weighted amount of oxygen absorbed in a light-off catalyst presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

12. Claims 5, 16, and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hepburn'685 as applied to claim 1 above, in view of official notice.

Re claims 5, 16, and 18, the apparatus of Hepburn'685 discloses the invention as cited above, however, fails to disclose that the three-way catalyst of the exhaust gas purifying means (32) has an oxygen storage value greater than an oxygen storage value of the light-off catalyst

(26); and that the light-off catalyst mainly purifies HC in an exhaust gas emitted from the engine in a cold state.

It is well known to those with ordinary skill in the art that the light-off catalyst (26) in Hepburn'685 is a relatively small catalyst with low oxygen storage capability as compared with the exhaust gas purifying means (32) and is located closer to an outlet of the engine where the exhaust gas temperature is still relatively high. In this way, the light-off catalyst (26) reaches an activation temperature at an earlier time in order to purify HC emitting from the engine in a cold state. Therefore, such disclosure by Hepburn'685 is notoriously well known in the art so as to be proper for official notice.

Re claims 19 and 20, in the apparatus of Hepburn'685, the light-off catalyst (26) includes a three-way catalyst having a function of an oxidizing catalyst (line 54 of column 2).

13. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hepburn'685 in view of official notice as applied to claim 5 above, and further in view of design choice.

The apparatus of Hepburn'685 discloses the invention as cited above, however, fails to disclose that an amount of oxygen absorbed on the three-way catalyst of the exhaust gas purifying means is not greater than about 150 cc per one-liter volume of the catalyst when measured by an oxygen pulse method and that an oxygen component stored in the three-way catalyst of the exhaust gas purifying means is not greater than about 25 gr per one-liter volume of the catalyst.

One having ordinary skill in the art of exhaust emission control would have recognized that the specification of the maximum volumetric or weighted amount of oxygen absorbed in the exhaust gas purifying means would be a function of many variables such as the size of the exhaust gas purifying means, engine size, engine operating conditions (load, speed, etc), air and fuel properties, capacity and size of a main catalyst, etc. Moreover, there is nothing in the record which establishes that the claimed maximum volumetric or weighted amount of oxygen absorbed in the exhaust gas purifying means presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

Response to Arguments

14. Applicant's arguments with respect to the references applied in the previous Office Action have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Prior Art

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of four patents.

- Hirota et al. (U.S. Patent 5,201,802) increase an injected amount of HC and increase a catalyst temperature when it is determined that the catalyst is deteriorated.

- Akazaki et al. (U.S. Patent 5,937,638) change an air-fuel ratio to a leaner value to maintain high NO_x conversion efficiency of a catalyst.

- Kato et al. (U.S. 5,953,907) use an upstream NO_x sensor and a downstream NO_x sensor to determine a NO_x storage efficiency of a NO_x storage catalyst. If the efficiency is reduced, a NO_x regeneration cycle is performed.

- Ishizuka et al. (U.S. Patent 6,185,929) reduce an enrichment degree of an air-fuel ratio to maintain high NO_x conversion efficiency of a catalyst.

Communication

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (703) 308-2833.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (703) 308-2623. The fax phone number for this group is (703) 872-9302. For After Final communication, the fax phone number is (703) 872-9303.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-1148.

Tu M. Nguyen

TMN

August 1, 2003

Tu M. Nguyen

Patent Examiner

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